UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/496,068	02/01/2000	Anil M. Murching	PU020211	5671

7590 07/29/2003

Joseph S. Tripoli, Patent Operations
Thomson Multimedia Licensing Inc.
PO Box 5312
Princeton, NJ 08543-5312

EXAMINER	
LAROSE, COLIN M	
ART UNIT	**PAPER NUMBER**
2623	12

DATE MAILED: 07/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/496,068	MURCHING ET AL.	
	Examiner	Art Unit	
	Colin M. LaRose	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 June 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-5,7 and 8* is/are rejected.

7)☒ Claim(s) *6* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Arguments and Amendments

1. Applicants' arguments and/or amendments filed 28 June 2003, have been entered and made of record. Claim 2 has been canceled. Claims 7 and 8 have been added.

Response to Amendments and Arguments

2. Applicant's arguments with respect to newly amended claim 1 have been fully considered but they are not persuasive for at least the following reasons.

Applicant argues that "the digitization step of claim 1 is not the same as specified by the Examiner". Examiner appreciates the differences between the present invention and the prior art reference Shafarenko. However, claim 1 merely calls for "digitizing the color gradient field" and does not specify any details of the "digitizing". Broadly interpreted, "digitizing" can denote the fact that the color gradient field is simply placed in digital form. As stated in paper 9, Shafarenko discloses this limitation.

Applicant argues that Shafarenko does not use a watershed algorithm to segment the smoothed gradient field into a "set of spatially connected regions of homogeneous color" and points out that the passage relied upon by the Examiner does not expressly disclose that the image is segmented into a "set of spatially connected regions of homogeneous color".

Shafarenko's entire paper relates to "Automatic Watershed Segmentation of Randomly Textured Color Images". Specifically, Shafarenko uses a watershed algorithm to segment a color gradient field, thereby obtaining a segmented color image. It is clear, from the remainder of the

paper, that Shafarenko's watershed segmentation produces connected regions of homogeneous color. Shafarenko states that after the watershed routine is applied, "the image has been transformed into a patchwork of pieces of constant color" (page 1535, paragraph 5). Figures 6-9 illustrate examples of test images segmented into regions of homogeneous color using the watershed routine.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

4. Claims 7 and 8 are rejected under 35 U.S.C. 102(a) as being anticipated by "Incorporation of Derivative Priors in Adaptive Bayesian Color Image Segmentation" by Luo et al. ("Luo").

Regarding claim 7, Luo discloses a method for representing regions of homogeneous color in a digital picture (section 2.2, page 781: "As a result, an image will be segmented into regions of *uniform, or more often, slowly varying* colors") comprising the steps of:

dividing the digital picture into blocks (i.e. each pixel constitutes a block);

estimating a scalar gradient value for each block by defining a color gradient field corresponding to each block (Section 2.5: first-order derivatives are estimated from edge detection, which utilizes the vector gradient of the image. Luo uses the methods of Lee and Cok's "Detecting Boundaries in a Vector Field" for performing the edge detection. In section III

of Lee et al., a vector gradient (i.e. gradient field) is estimated for each point (pixel), wherein the vector gradient comprising the scalar magnitude of the gradient (see page 1182, paragraph beginning: “If one travels…”);

representing data corresponding to the digital picture as a probability distribution of blocks of the digital picture that are spatial[ly] connected and homogeneous in color for a search application (Luo represents the image data as a maximum *a posteriori* (MAP) probability using a Gibbs distribution in order to achieve a segmented image. A MAP estimation (equation (1)), which is modeled as a Gibbs distribution (equation (3)), defines the regions of spatially connected pixels that are homogeneous in color (i.e. the MAP estimate is used to segment the image by color). See figure 1. Also, the representation of the image data by a MAP estimation is for a search application that searches for the most probable segmentation of the image).

Regarding claim 8, Luo discloses a method for representing spatial relationships between regions of homogeneous color in a digital picture (e.g. figure 1: spatial relationship between homogeneous regions) comprising the steps of:

dividing the digital picture into blocks (i.e. each pixel constitutes a block);

estimating a scalar gradient value for each block by defining a color gradient field corresponding to each block (see corresponding explanation for claim 7);

representing data corresponding to the digital picture as a probability distribution function calculated in view of blocks of the digital picture that are homogeneous in color and distances between the blocks that are homogeneous in color (Luo represents the image data as a maximum *a posteriori* (MAP) probability function using a Gibbs distribution in order to achieve

a segmented image, as explained above for claim 7. Luo discloses that the MAP function is calculated in view of blocks of the digital picture (i.e. it is calculated based on the pixels of the digital picture). Luo also discloses that the MAP function is calculated in view of distances between the blocks (i.e. it is based on the first-order derivatives, which are derived from the gradient magnitudes, or distances between blocks (see section 2.5). It should be noted that pixels are homogeneous in color – they exhibit the same color throughout the area of the pixel. Therefore, every block of Luo is homogeneous in color).

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1 and 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shafarenko in view of "Unsupervised Video Segmentation Based on Watersheds and Temporal Tracking" by Wang.

Regarding claim 1, Shafarenko discloses a method of extracting regions of homogeneous color in a digital picture comprising:

dividing the digital picture into blocks (Shafarenko operates on pixels, which are the smallest image blocks); and

merging together spatially adjacent blocks that have similar color properties to extract the regions of homogeneous color (Abstract: watershed routine is used to merge pixels according to color contrast).

Shafarenko discloses the merging step comprises:

extracting a feature vector for each block (Shafarenko processes pixels in LUV color space; the L, U, and V values for each pixel comprise a feature vector);

estimate a scalar gradient value for each block as a function of the feature vector, the set of gradient values defining a color gradient field (Section B, paragraph 2, page 1533: each pixel is assigned an LUV gradient value according to the maximum Euclidean distance to the furthest neighbor; the set of all gradient values produces a field);

segmenting the gradient field with a watershed algorithm that divides the gradient field into a set of spatially connected regions of homogeneous color (third paragraph, page 1531: watershed algorithm uses LUV gradient to segment image by color).

Shafarenko is silent to digitizing the color gradient field. However, Shafarenko's method is implemented on a computer, so any computed values are digital.

Shafarenko is silent to preprocessing the digitized color gradient field to produce a smoothed color gradient field.

Wang discloses a similar segmentation routine, wherein image gradients are applied to a watershed algorithm to segment an image into homogeneous regions. Wang teaches smoothing the gradient field prior to utilizing it for the watershed algorithm. Wang dilates then erodes the gradient image, thereby reducing local minima caused by noise or quantization error (Section A, step 3, page 540).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Shafarenko by Wang in order to preprocess the color gradient field as claimed, since Wang teaches smoothing the gradient field removes noise.

Regarding claim 3, Shafarenko discloses the extracting step comprises:

transforming the data in each block into a perceptually uniform color system (Section B, page 1533: pixels are placed in perceptually uniform LUV color space);

calculate N moments of the data in each block for each color component, the set of moments being the feature vector for the block (there is only one element in each block, so the moment is simply the L, U, and V values of the pixel).

Regarding claim 4, Shafarenko discloses the estimating step comprises:

selecting the maximum of the distances between the feature vector of each block and the neighboring vectors as the gradient value for the block (Section B, paragraph 2, page 1533: each pixel is mapped onto the distance to its furthest neighbor).

Shafarenko does not expressly disclose obtaining distances between the feature vector of each block and the feature vectors of each neighboring block. However, in order to find the maximum distance, all of the distances must be known. Therefore, this step of obtaining is implicit in Shafarenko's teaching.

Regarding claim 5, Shafarenko teaches applying a weighted Euclidean distance metric to the feature vectors to determine the distances (Section B, paragraph 2, page 1533: Euclidean distance is used to estimate the gradient; weighting is unity since there is only one moment for each block).

Allowable Subject Matter

7. Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 6, Shafarenko is silent to converting the feature vector into a pmf-based representation for each color component and then computing and selecting, as claimed.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

"An Adaptive Bayesian Approach for Color Image Segmentation" by Chang et al. discloses details of the probability model upon which Luo's segmentation method is based.

"Detecting Boundaries in a Vector Field" by Lee et al. discloses details of edge-detection and gradient calculation incorporated by Luo.

"Relaxation Methods for Supervised Image Segmentation" by Hansen et al. discloses a color segmentation method based on gradients, watershed analysis, and probability modeling (see section 4.1).

U.S. Patent 5,585,944 by Rodriguez discloses a method of compressing an image by dividing the image into blocks of homogeneous color.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489.

The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (703) 306-0377.

AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

CML
Group Art Unit 2623
24 July 2003